Space Weather Technical Forecast

Issued on Friday, 05 August 2022 at 12:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the past 24 hours with isolated C-class flares. There are currently five numbered regions on the disc, most of which are small, weak and magnetically stable. The largest region on the visible disc continues to be AR3068, (Esi/beta), which remains stable. A possible Earth-directed CME (coronal mass ejection) was observed from a flare at 05/0744UTC from AR3073 (Cso/beta) one of the newly emerged regions on the southwest quadrant. Analysis of the imagery is ongoing.

Solar Wind / Geomagnetic Activity: The solar wind started at slightly elevated levels, as measure at L1, under the residual influence of a high speed stream from coronal hole 07. The solar wind then gradually and erratically declined from 460 km/s to around 400 km/s. Density was mostly near average throughout, weak. The total interplanetary magnetic field (IMF), Bt was weak, with a brief increase to moderate around 05/0045UTC, peaking at 9nT.. The north-south component, Bz, fluctuated weakly between +6/-9 nT. The Phi angle remained negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at background levels. The high energy electron flux (greater than 2 MeV) was at background to moderate levels, peaking at 298 pfu at 04/1645 UTC. Electron fluence was steady, remaining well below the Active threshold (1e8 integrated flux), with an observed fluence value of 8.07e6 integrated pfu recorded at 05/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is likely to continue for today and tomorrow, with a slight chance (20%) of an M-class flare. By day 3 an active region may rotate from the far side onto the visible disc, therefore the probability of significant flares increases slightly.
Solar Wind / Geomagnetic Activity: A possible Earth directed CME has been assessed from available imagery and this will be analysed further once imagery becomes available. Initially slightly elevated solar winds will continue to decline to slow-ambient in the next few hours. Then from late tomorrow (6th) a new HSS is expected to arrive. As solar wind speeds strengthen, so the geomagnetic activity increases. Geomagnetic activity should remain Quiet with a chance of Unsettled intervals today and for much of tomorrow (6th), then becoming Unsettled to Active (Kp 3-4) later tomorrow and overnight into day 3 (7th), with a slight chance of isolated G1/Minor geomagnetic storm (Kp 5) intervals occurring. Through day 4 (8th) activity is expected to decline to mainly Quiet levels (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is expected to remain mostly at background to moderate levels, but with a chance of approaching

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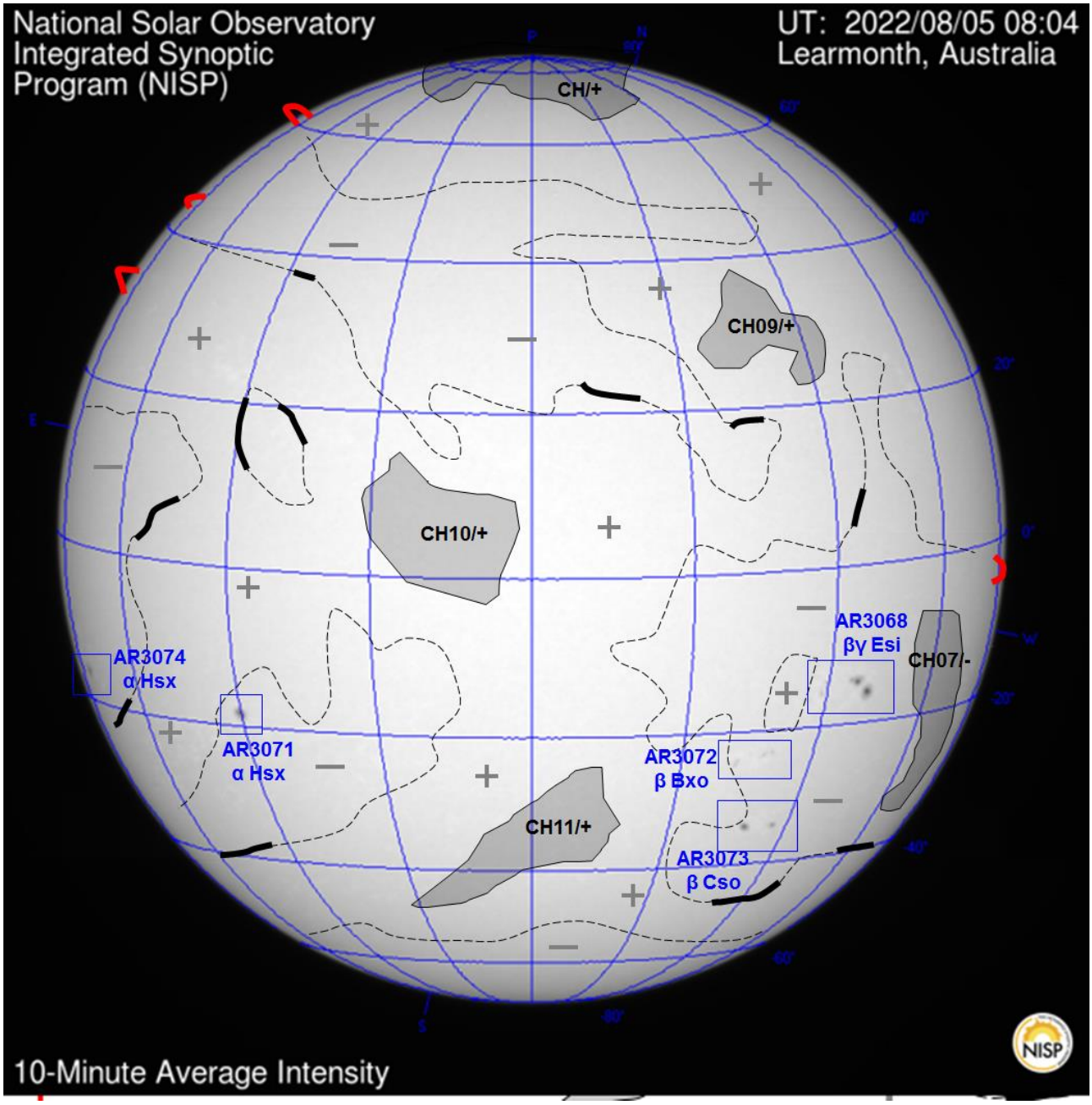
high levels at the diurnal maxima during day 4 (8th). The corresponding 24 hour fluence is most expected to remain below the Active threshold (1e8 integrated pfu), with initially a steady trend but then an increasing trend through day 4 (8th).

Figure 1. Solar Analysis Valid 0800 UTC, 5 August 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

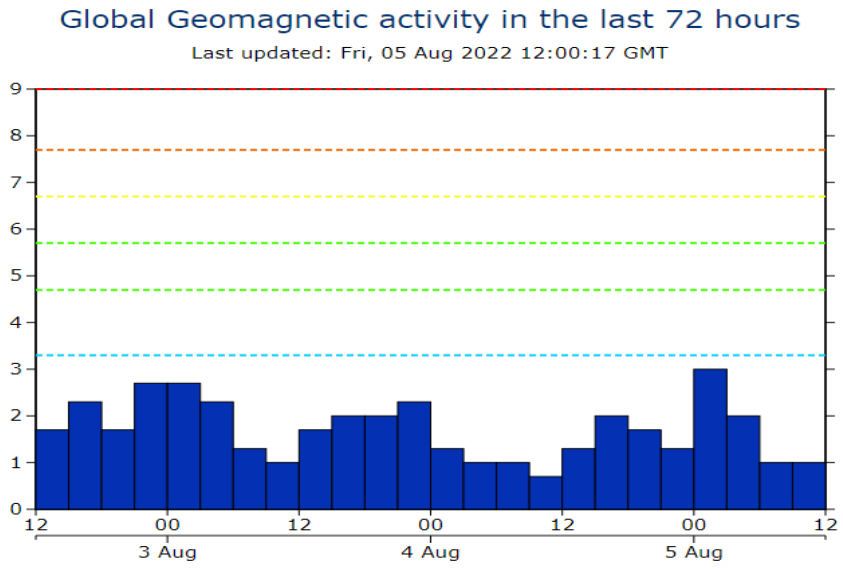
A possible Earth-directed CME (coronal mass ejection) was observed from a flare from newly emerged AR3073 at 05/0744UTC and this is one of the regions on the southwest quadrant. Analysis of the imagery is ongoing. Earth is currently gradually exiting the High Speed Stream of CH07/-, with initially slightly elevated solar winds but these declining slow-ambient through the remaining hours of today. Then from late tomorrow (6th) a new HSS is expected to arrive, from CH09/+. Although this feature appears weak in imagery, recent data from Stereo Ahead indicates that solar wind speeds of 500-550 km/s are likely, following a potentially significant CIR (Co-rotating interaction region).
Geomagnetic activity should remain Quiet (Kp 0-2) with a chance of Unsettled (Kp 3) intervals today and for much of tomorrow (6th), then increasing Unsettled to Active (Kp 3-4) later tomorrow and overnight into day 3 (7th), with a slight chance (20%) of isolated G1/Minor geomagnetic storm (Kp 5) intervals occurring. Through day 4 (8th) activity is expected to decline to mainly Quiet levels (Kp 1-2).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	20	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: BGS Magnetometer data showing mostly Quiet geomagnetic activity in recent days.



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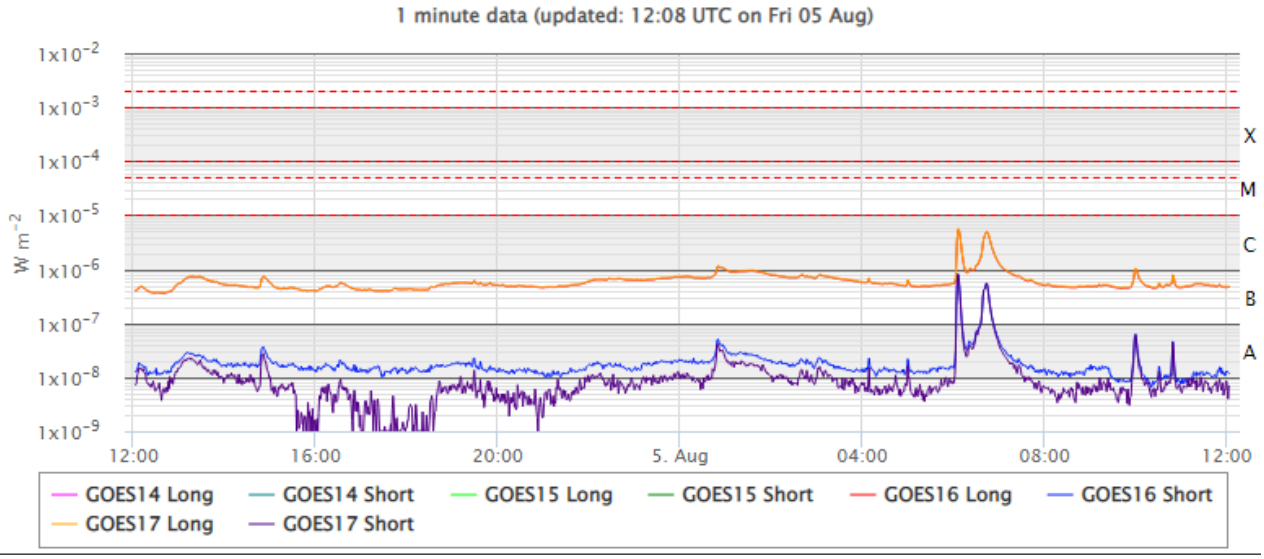
Radio Blackouts - X-Ray Flares:
Solar activity has been low over the past 24 hours with isolated C-class flares. There are currently five numbered regions on the disc, most of which currently appear to be weak and magnetically stable. The largest region on the visible disc continues to be AR3068, an Esi/beta, which remains stable. A newly emergent and newly numbered sunspot group AR3073 (Cso/beta) gave rise to a C5 x-ray flare at 05/0644UTC, and it looks likely that this produced a CME which may well be earth-directed.
Low solar activity is likely to continue for today and tomorrow, with a slight chance (10%) of an M-class flare. From day 3 an active region may rotate from the far side onto the visible disc, therefore the probability of significant flares increases slightly.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	20	20	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot over the past 24 hours with isolated C-class flares, mostly occurring in recent hours.



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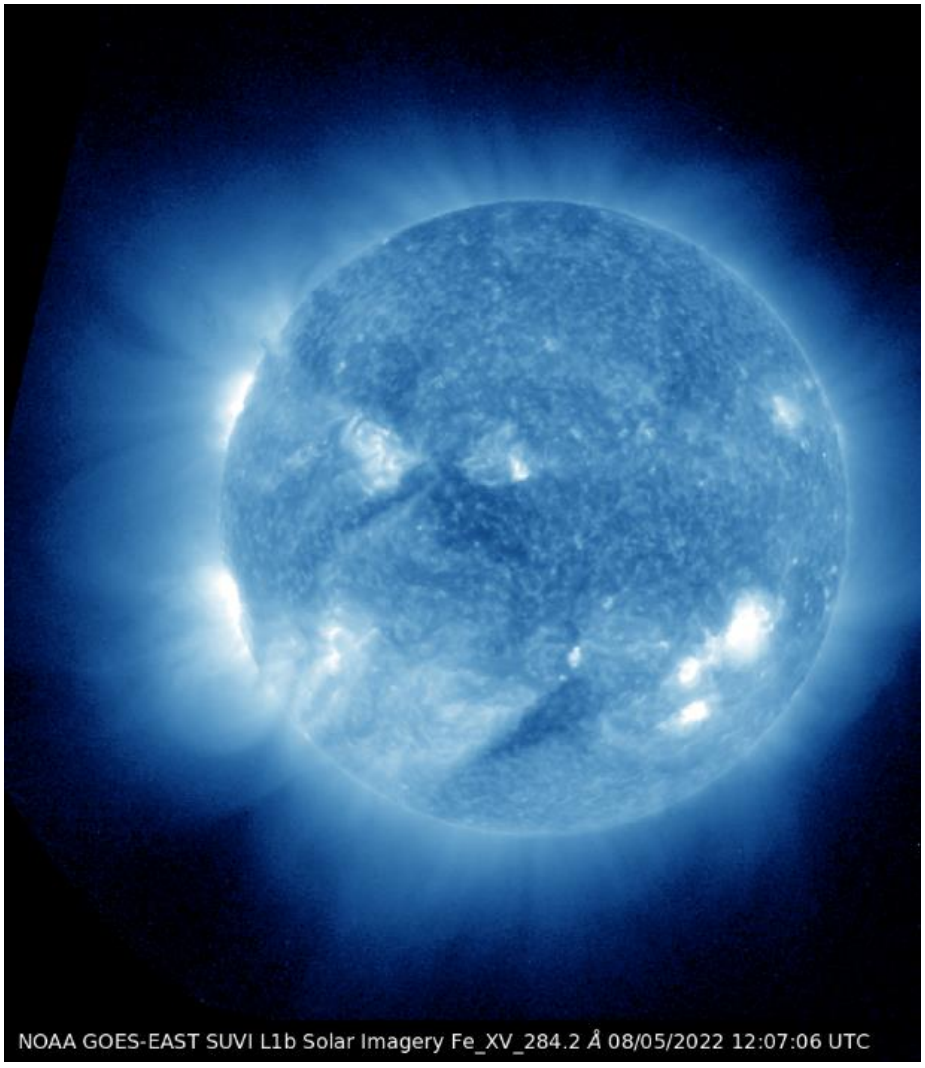
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) is currently at Background levels and is expected to remain at this level through the period. AR3068 will need monitoring for any further development, however, with the potential to increase radiation storm risks as it transits across the western hemisphere of the solar disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: NOAA GOES EAST SUVI latest available image of visible disc, showing Active Regions and coronal hole activity.



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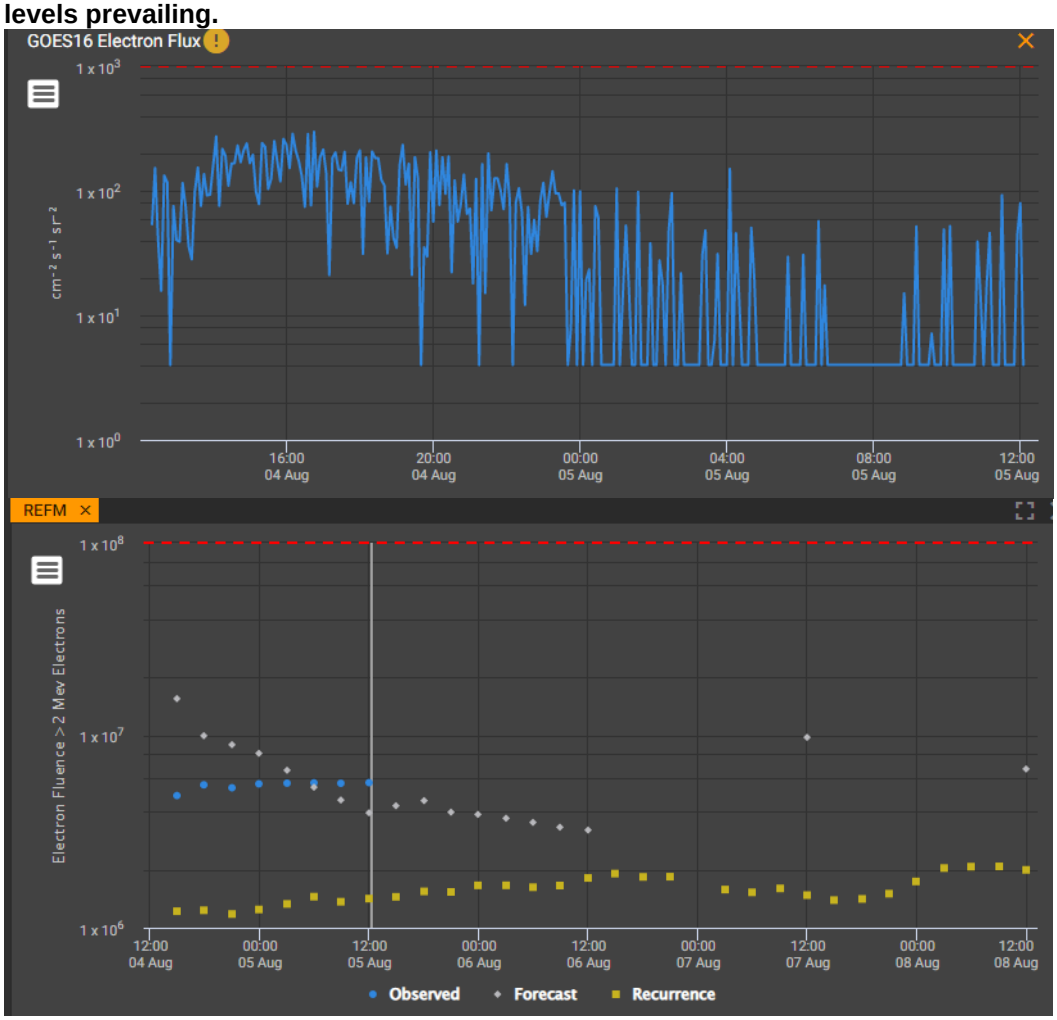
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as measured by GOES-16, is expected to remain mostly at background to moderate levels, but with a chance of approaching high levels at the diurnal maxima by day 4 (8th). The corresponding 24 hour fluence is most expected to remain below the Active threshold (1e8 integrated pfu), with initially a steady trend but then an increasing trend through day 4 (8th)

Despite the Met Office REFM output currently over estimating the electron fluence, the overall guidance of the model is considered good, with the forecast fluence remaining below the Active threshold for days 1-3 (6-8th).

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	5	10	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: High energy electron flux and Met Office REFM output (lower) with mostly background levels prevailing.



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